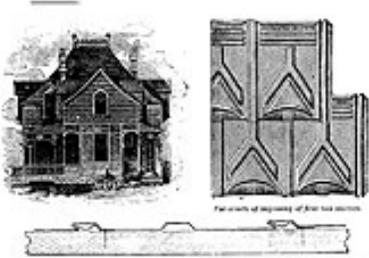


ROOFING FOR HISTORIC BUILDINGS

Metals

Metals are useful both as the roof surface itself, and as important components such as flashings, valleys and gutters on roofs of other materials. The malleability of metal allows it to be formed and joined making it useful for weatherproofing the junctures and angles on roofs. These same properties also make it suitable for roofing curved and irregular surfaces and for roofing where the pitch is too low for simple overlapping material to provide waterproofing.



IF YOU ARE INTERESTED IN ROOFING, send for our price list and illustrated shingles, which is special to the trade. We are pioneers in the introduction of practical metal shingles, and no imitator has yet produced their equal. Our goods are largely used throughout the United States and Canada; they are used by the Government and railroads, approved by the Insurance companies and many leading architects and builders. They are lighter than slate, and will last longer when properly used; the low cost of laboring on our roofing will, in a short time, more than balance the difference in price where wood shingles are shingles.

As soon by the day, our shingles are the same to-day as when first introduced. Remember, no chains or springs are necessary in using our shingles. The lock is simple and perfect, with corrugations across the top, and facing corrugations across the exposed end of the shingles, which will hold the shingles firmly in the underlying courses. They are easily applied, and any one who can lay a wood shingle can lay these. We furnish them in five sizes, made from various materials, galvanized iron, and especially galvanized tin plate, which is superior to galvanized iron; cold rolled copper and steel plates. We keep on hand a full line of roofing supplies.

Our shingles received the highest and only award for metal shingles at the American Centennial held in this city, October, 1876, and New Orleans Exposition, 1874.

The National Sheet Metal Roofing Company,

508, 510, 512, 514, 516, 518, 520 EAST 20th STREET, NEW YORK, U.S.A.

BRANCH OFFICES:

W. W. MONTAGUE & CO., 200 Franklin, Cal. Pacific Coast.
 KENNEDY & WELLES, CHICAGO, ILL. J. J. WALTERS, Denver, Col.
 PHILLIPS & HUTTON, MANHATTAN, N.Y., Brooklyn, Tenn.
 WOODWARD, KENNEDY & CO., THE GREAT BRITAIN, Agents for Canada.
 J. BROWN, TORONTO, & CO., MONTREAL, QUEBEC, CANADA.

This advertisement from an 1888 publication of house designs, **Homes of Today**, offered stamped shingles in four materials. [click image for larger view]

As with other roofing materials, the earliest uses of metals for American roofing employed imported products. Lead, copper and tin plate most often came from Great Britain, while the first zinc came from Belgium. As mines and mills opened in the United States, domestic production replaced imports. In the case of tin, the success of domestic production depended on the advantage of a tariff on imported tinplate imposed by the McKinley Bill of 1890.

Several factors contributed to the popularity of metal roofing throughout much of the 19th and early 20th centuries—it was lighter than slate or tile, it offered more fire protection than wood, and most metals were less expensive than slate or tile.

Metals are applied to roofs as shingles and as pre-formed and

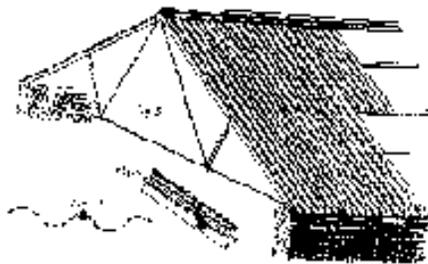
site-formed sheets. The first metal shingles were small flat rectangles; surviving examples from 1819 at the University of

Virginia in Charlottesville were interlocked at the sides with folded edges and simply lapped at top and bottom. Not until the 1870s was mass production applied to metal shingles.

Stamping sheets of metal was an innovation that added rigidity to a thin material and facilitated interlocking edges, reducing needed lap and preventing wind lift. Patterns were frequently patented and were produced in iron, tinplate, galvanized steel or copper.

Sheets of iron were first pre-formed by corrugation in England in 1828. American manufacturers were producing corrugated

roofing from both plain and galvanized iron by mid-19th century. Corrugation added stiffness, making the material self-supporting over longer spans and eliminating the need for sheathing or closely-spaced framing. Thus, corrugated



The corrugated sheets of "Patent Galvanized Iron" produced by Marshall Lefferts & Brother are shown in their 1854 catalog, where it is pointed out that the supporting framing may be one-fourth as heavy as would be required for slate. [click image for larger view]

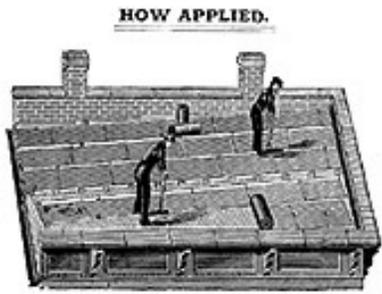


Aluminum

The small amount of aluminum manufactured before the turn of the century limited its application as a building material. Its early use in 1890 on the roof of Philadelphia's City Hall combined it with copper, and it quickly failed. By the 1920s the material was better understood, and Alcoa was marketing both rolled aluminum sheets and an interlocking shingle for roofing in natural and painted finishes. Difficult to solder, aluminum roofing relied on mechanical joints and pitch to shed water.

Copper

The New York City Hall (1764) was a notable early use of copper for roofing. Though copper roofs were installed on many important buildings in the early 1800s, it was infrequently used until the latter 19th century, when the Lake Superior mines opened in Michigan's Upper Peninsula. Even then copper was more often used for flashings, gutters and downspouts than for roofing. Copper has always been an expensive choice for roofing, but it is easily worked, does not need a coating and weathers attractively. These factors all contribute to copper's use most often and to greatest advantage on the ornamental roofs of major public buildings.



EXPLANATIONS TO FIGURE:

1. THE ROOFING IN ROLLS.
2. THE ROOFING AS UNROLLED.
3. CROSS LOCK OF FLAT SEAM.
4. 1/2 INCH EDGE TURNED UP WITH TONGUE.
5. 1/2 INCH EDGE TURNED UP WITH FLANGE.
6. CLASPS OR FASTENINGS.
7. MAN TURNING EDGES WITH TONGUE.
8. MAN FOLDING EDGES WITH BEAKER.
9. FINISHED STANDING FOLDED LOCK SEAM.
10. FLASHING ALONG THE FIRE WALL.
11. LAP TO TURN DOWN AT GABLE AND GABLE EDGES.
12. GABLE BROOK.

iron was well suited for inexpensive, quickly assembled buildings, making it a common material for the construction that accompanied the California Gold Rush. Later in the century, manufacturers offered flat sheets with edges pre-formed for standing seams or in a V shape as economical alternatives to onsite fabrication.

Unlike the simple lapped installation used for corrugated or V-edge sheets, most site-formed metal roofing utilizes various folded, interlocking joints to create a weatherproof covering. Metals that can be fused (lead) or soldered (tin, terne, zinc, copper) can have sealed joints, thus removing slope as a factor in the water-shedding performance of the assembly. Solder was usually applied to seal interlocked seams that had been folded flat. Flat seams joined small sheets of metal to cover curved shapes or very low-sloped roofs. They were also used to create long strips of

This illustration from the 1893 catalog of a Philadelphia manufacturer describes the application of a roof made from their iron or steel that had been seamed into rolls at the factory, from sheets measuring 26x104 inches. The technique would have been the same for a roof of tinplate, terne plate or copper. [click image for larger view]

a metal such as tinplate, which was only available as small sheets. When the long strips were laid parallel to the slope of a roof (minimum 2 in 12 slope), the long edges could be joined without solder if the joints were raised above the rest of the roof surface as a rib. Usually the adjacent edges were folded over each other creating a standing seam. Many metals were used for this common roof. Variations on the system formed the seam over battens or used separate cap pieces to join the bent edge flanges. Although requiring slightly more material, a standing seam better accommodates the expansion and contraction of metal than does a flat seam roof.



Copper was put to effective use on the roof of the 1913 Handley Library in Winchester, Virginia. (NPS photo) [click image for larger view]

[metals continued...](#)



[Heritage Preservation Services](#)



ks

Iron

Both iron and steel without any plating were used for roofing. The Philadelphia home of the mill owner who rolled the first sheet iron in the United States was roofed in the material around 1794. Iron replaced slate on the White House in 1804. Because it was available in large sheets, rather than the small sheets used for plated material, it required fewer joints. Some manufacturers produced factory painted material, but late 19th century accounts indicate that paint was an inadequate defense against the corrosive effects of the atmosphere in industrial regions.

Lead

The earliest use of lead for roofing in this country may have been at Rosewell, an 18th-century plantation house at Whitmarsh, Virginia. It was widely used before the American Revolution for flashings, downspouts and gutters on the best buildings. In the United States, lead never achieved the popularity it had in Europe. Installed on early Federal buildings in Washington, D.C., it failed to perform well. Expansion and contraction due to temperature changes produced fatigue, and on steep roofs the effect of gravity caused creep. In the 20th century lead found additional application as a coating for both steel and copper.

Zinc

Rolled sheet zinc appeared in the United States in 1816, as roofing in New York and as downspouts and gutters in Baltimore. Though more than seventy houses in New York had zinc roofs by 1837, it was out of favor by 1840. The popularity of the material was cyclical in the next decades, never matching iron and steel with their various coatings.

Coated Ferrous Metals

Plating protected the base metal from rust and allowed the material to be soldered.

Tin and Terne

Tin-plated iron appeared as a roof covering in the United States at the beginning of the 19th century. Thomas Jefferson chose it for Monticello in 1800. Tin was often referred to as "bright tin" to distinguish it from the lead-tin mixture, terne (meaning "dull" in French). Because the plating process required that the base iron be dipped into molten tin, it could only be produced in small sheets. The sheets measured 10 by 14 inches in the 1830s, but by the 1870s, advances in manufacturing increased the size to 20 by 28 inches. Tin's availability and reasonable cost made it a very common roofing through much of the 19th century. It could be quite durable, but only if kept well painted.



Painting the verandah roof in stripes following the seams in the metal was a fashionable treatment before the Civil War. Manufacturers and technical manuals recommended painting the underside of the metal as well as applying two or three coats to the top. Paints of iron oxide in linseed oil and white lead paint were variously recommended. Since the iron oxide produced a red or brown color, the stripes depicted would have required a tinted white lead paint. (Courtesy of The Athenaeum of Philadelphia) [click image for larger view]

Galvanized

Iron or steel are galvanized by coating them with zinc. Rather than producing the simple coating created by tinplating, a rust resistant alloy of the two metals forms on the surface. In 1839, two years after galvanizing was patented in Europe, the material was used on the roof of the Merchants Exchange in Manhattan. Though the sheet iron was hand dipped in the zinc, much as it was in tin, larger sheets were used (24 by 72 inches in the 1850s). This meant fewer joints, and when used as corrugated sheets, less supporting framing. Even as the production of galvanized iron and steel roofing products increased, the price remained higher than that of other metals. The price differential did not shrink sufficiently for galvanized roofing to exceed tin and terneplate in popularity until the 20th century.

Enameled

Enameled steel as a building component came to this country by way of Germany at the end of the 19th century. Shingles of enameled steel were exhibited by a German industrialist at the 1893 World's Columbian Exposition. The first American production was in 1924 by the Columbian Enameling and Stamping Company, which roofed a house in Terra Haute, Indiana, with enameled shingles. Commercial markets developed by 1930, and enameled shingles became popular for use on service stations and chain restaurants. Except for the 2500 Lustron houses manufactured in the late 1940s, the material was rarely used in residential applications.

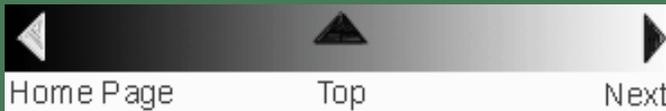


Downing describes the chevron patterned roof of his Design XXXI, "Villa in the Pointed Style," from **The Architecture of Country Houses** published in 1850: "The roof may be covered with zinc laid on a ribbed sheathing, without soldering so as to allow it to expand and contract without detriment."(Courtesy of The Athenaeum of Philadelphia) [click image for larger view]

Terneplate was first produced in United States in New York in 1825. Joseph Truman of Philadelphia patented the lead coating of tinplate in 1831. Later production combined the lead and tin into a single coating. Called variously "leaded plate," "roofing tin", and "roofing plate," terne was cheaper than a pure tin coating, but its properties were very similar. Domestic production of terne was twice that of tin when it was chosen to roof the buildings of the 1893 World's Columbian Exposition. In the next few decades terne replaced tin completely in American production as steel replaced iron as the base metal.



Emphasizing its two trademark components this enameled shingle was described in the 1929 **Sweet's Architectural Catalogue**: "The base Armco ingot iron and the two coats of Pemco glass fused together at 1600 degrees F., produce a roofing tile extremely durable and of permanent beauty." (**Sweet's Architectural Catalogue**, 1929. Courtesy of The Sweet's Group, The McGraw-Hill Companies, Inc.) [click image for larger view]



Heritage Preservation Services



ks